

In the Claims

A complete listing of the claims of the application follows:

Claims 1. through 3. (Cancelled)

Claim 4. (Previously presented) A process for producing catalysts comprising

preparing a mixture of a phyllosilicate and an activating acid;

adding iron cations to the mixture of the phyllosilicate and the activating acid;

activating the phyllosilicate by use of the activating acid in the presence of the iron cations by boiling the mixture;

separating a solution formed during the acid activation which contains excess iron cations from the activated phyllosilicate to produce the catalysts.

Claims 5. through 7. (Cancelled)

Claim 8. (Previously presented) The process of Claim 4 wherein the phyllosilicates are selected from the group consisting of smectites, chlorites, illites, vermiculites of the serpentine-kaolin group and of the sepiolite-palygorskite group including montmorillonite, beidellite and nontronite.

Claims 9. and 10. (Cancelled)

Claim 11. (Previously presented) The process of Claim 4 wherein the acid activation is carried out in the presence of an earlier acid activation solution, which solution contains aluminum

ions.

Claim 12. (Previously presented) The process of Claim 4 wherein the acid activation is carried out in the presence of an earlier acid activation solution, which solution contains aluminum and iron ions.

Claims 13. through 15. (Cancelled)

Claim 16. (Previously presented) The process of Claim 4 wherein the phyllosilicates after acid activation in the presence of catalytically active cations are washed, dried and calcined.

Claims 17. through 19. (Cancelled)

Claim 20. (Previously presented) A proton-catalyzed or Lewis acid-catalyzed reaction conducted in the presence of a catalyst comprising preparing a catalyst by the process of Claim 4 and conducting the proton catalysis or Lewis acid-catalyzed reaction utilizing that catalyst.

Claims 21. through 28. (Cancelled)

Claim 29. (Previously presented) The process of Claim 4 wherein the iron ions are added to the mixture of phyllosilicate and activating acid in the form of a solution.

Basis for Amendment

The applicant amends the sole remaining independent claim, Claim 4, of the application to introduce the process step whereby the mixture of the phyllosilicate and the activating acid with iron cations is activated "by boiling said mixture". The activation is performed by blending the raw clay with an aqueous solution containing the iron cations and an acid at boiling temperatures. Basis for this amendment is contained in the combination of examples 1 and 2. Example 2, which is an inventive example, states that the clay mixed with iron chloride and hydrochloric acid is activated in a process analogous to the process disclosed in Comparative Example 1. (See page 6, last four lines.) The method of activation in Example 1 is discussed in the first four lines of the first full paragraph on page 6 of the application as follows:

During decomposition, 90.3 g of raw clay with a water content of 16.9% by weight together with 250.7 g water and 87.5 mg of 30% hydrochloric acid were treated in a three-neck flask with a reflux condenser for 8 hours at the boiling point. (Emphasis added.)

(Thus, basis exists for the amendment to the claims.)

In Example 2, the one major distinction from the process of Example 1 is that iron chloride is added to the mixture containing raw clay, water and hydrochloric acid prior to the heat treating of the mixture at boiling.

The effect of this new process is that many ions, predominantly aluminum ions, are extracted from the clay into the

aqueous acid solution. A high concentration of ions other than iron ions are present in this solution. All of the ions present in the aqueous solution can ion exchange with the clay. It was surprising that, although a large quantity of various cations different from the added iron ions are present in the solution, the iron ions preferentially bind to the clay, thereby activating the clay. It was also surprisingly discovered that this activation advantageously occurs when the reaction process is performed under boiling conditions, as disclosed in Examples 1 and 2.

Discussion

In the final Office Action, the United States Patent and Trademark Office rejected the remaining claims of the application under 35 USC §103(a) as being unpatentable over Shaked et al. In addition, the USPTO rejected claim 20 under 35 USC §102(b) as being anticipated by, or in the alternative under 35 USC §103 as being obvious over, EP 0925829. The applicant respectfully asserts that the claims of the application are not taught by the prior art that is cited.

Shaked et al.

The applicant specifically asserts that Shaked et al. fail to make the claims of the application obvious. To enhance this distinction, the applicant has amended the claims.

Shaked et al. discloses a different process for the activation of the clay than the process claimed in the application. What is preferentially taught in Shaked et al. is the activation of the clay using a Lewis acid. In fact, Shaked et al. teach that the use of Lewis acids are superior to the use of conventional activating acids, such as sulfuric acid. "The results show that the Lewis acid enhanced product of the present invention has a significantly higher pH, removes chlorophyll better, removes soaps equally well, and has slightly lower FFA compared to the H₂SO₄ enhanced product." (Column 6, lines 9-13) This preference for the use of Lewis acids over conventional acids, such as sulfuric acid, is also discussed

in Example 3 at column 4, lines 29-34.

In contrast, nowhere in Shaked et al. is it taught that a clay mixed with the acid, with or without the addition of the iron ions, should be treated by boiling the materials in an aqueous solution to enhance the ion exchange of the iron ions. In fact, the process of Shaked et al. occurs preferentially at significantly lower temperatures. For example, the preferred method for the addition of Lewis acids is to combine the clay material with "a dry, granular Lewis acid." Even if the Lewis acid is blended in an aqueous solution, there is no indication that the temperature of that aqueous solution should be at or near the boiling temperature of the solution.

The metal salts that are Lewis acids can be combined with the clay material in any convenient manner such as by blending a moist clay with a dry, granular Lewis acid, by mixing with an aqueous solution of a Lewis acid, or the like. (Column 4, lines 12-15)

Similar language is contained in Example 1, lines 12-16. At no point in Shaked et al. is there any teaching of heating the Lewis acid to boiling temperatures with the clay to produce the ion exchanged end product.

Accordingly, there is no teaching in Shaked et al. of a preference for blending an aqueous solution of the clay with an activating acid and iron cations and boiling that mixture. In fact, by the statement that it is as preferable to use "dry, granular Lewis acids", the application specifically teaches away

from boiling as an acceptable method for the treatment of the clay. Accordingly, Shaked et al. not only fail to disclose this important process step, as claimed, but in fact teach away from that process.

EP 0925829

The EP reference specifically fails to teach the catalyst produced by the process, as claimed, not only for the reasons previously stated in the response to the earlier Office Action, which is incorporated herein by reference, but also for the following reason.

The process that is disclosed in the EP reference is the combination of a clay material with an acid, which is then heated at a maximum temperature of 95°C. "The treating temperature is selected from a range of from 80 to 95°C and the treating time ..." (Page 7, ¶0064, lines 55-57) In each of the examples, the treating temperature of the solution containing the clay and the acid is 90°C. (See Examples 2, 3, 4 and 5; page 10, lines 49-50; and page 11, lines 5-6, 17-18 and 38-39.)

Accordingly, the EP reference also fails to teach a catalyst produced utilizing this important process step, which is now specifically claimed in the claims of the application. Because the process is not disclosed by EP 0925829, the catalyst produced by this process cannot be the same as the catalyst claimed in Claim 20.